USDA Natural Resources Conservation Service

Ecological site R108XD860IA
Loess Upland Prairie

Last updated: 10/17/2024
Accessed: 05/12/2025

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 108X–Illinois and Iowa Deep Loess and Drift

The Illinois and Iowa Deep Loess and Drift, Western Part MLRA covers parts of both Iowa and Missouri and is known locally as part of the Southern Iowa Drift Plain. A silty loess deposit of varying thickness (5 to 20 feet) covers a series of glacial advances known collectively as pre-Illinoisan till. This till, deposited more than half a million years ago, was subjected to multiple instances of extreme erosion as well as periods of subdued erosion and intense weathering. The loess is thickest in the western part of the MLRA and generally thins eastward. In some areas, the loess has been removed and the older weathered till, called a “paleosol,” entirely exposed. These highly weathered soils, or paleosols, have a high content of clay, which slows the downward movement of water through the profile and causes water to move laterally instead of vertically. Wet areas, or “side-hill seeps,” commonly form where these paleosols become exposed along hillsides (Prior, 1991).

The dominant soil orders in this MLRA are Mollisols and Alfisols and, to a lesser extent, Entisols and Inceptisols. Most of the soils are Udolls or Udalfs. Aquolls are on the flatter interfluves. The soils in the area dominantly have a mesic soil temperature regime, an aquic or udic soil moisture regime, and mixed mineralogy. They generally are very deep, well drained to poorly drained, and silty, loamy, or clayey. These soils on uplands include somewhat poorly drained, nearly level Argiudolls (Macksburg series); moderately well drained, gently sloping to strongly sloping Argiudolls (Sharpsburg series); poorly drained, nearly level Argiaquolls (Winterset series); and well drained strongly, sloping to steep Hapludalfs (Gara, Lindley, Ladoga, and Armstrong series) (USDA-NRCS, 2006). The western part of the Illinois and Iowa Deep Loess and Drift is a segment of three other MLRAs within the Central Feed Grains and Livestock Region. The other areas are: the West-Central part (108C), the East-Central part (108B) and the Eastern part (108A).

Classification relationships

Major Land Resource Area (MLRA): Illinois and Iowa Deep Loess and Drift, Western Part (108D)

USFS Subregions: Central Dissected Till Plains Section (251C); Loess Hills (251Cb) and Central Dissected Till and Loess Plain (251Cc) Subsections (Cleland et al, 2007)

Relationship to Other Established Classifications:
NatureServe Classification: Ecological System: Central Tallgrass Prairie (7134); Ecological Association: Central Tallgrass Big Bluestem Loess Prairie (NatureServe, 2013)

Landfire Biophysical Setting: Central Tallgrass Prairie (4314210) (Landfire, 2009)

Ecological site concept

Loess Upland Prairies are formed in loess parent material and are on ridges, interfluves, and hillslopes on uplands. There is no bedrock within a depth of 80 inches. Loess thickness is greater than 1 foot. Slopes are less than 15 percent. Typically, these sites are located upslope from till ecological sites. Soils are typically Mollisols, characterized by deep, dark-colored surface horizons that have a high content of organic matter due to the dominant prairie vegetation and have no rooting restrictions.

Historic plant communities consisted of mostly grasses and a few forbs. Shrubs and trees are nearly absent at these sites. Plants endemic to the site include *Andropogon gerardii* and *Sorghastrum nutans*, which typically exceed 1 meter in height. *Schizachyrium scoparium*, which is also very common, is shorter. Other species that are commonly found in this community include *Solidago canadensis*, *Dichanthelium acuminatum*, and *Coreopsis tripteris*. Common invasive plants include *Poa pratensis* and *Bromus inermis*.

Associated sites

R108XD864IA	**Wet Upland Prairie** Wet Upland Prairie. Fine textured soils, including Sperry, Winterset, Clearfield, Clarinda and Rinda.
R108XD824IA	**Wet Upland Drainageway Prairie** Wet UPland Drainageway Prairie.Fine and fine-silty soils, including Ackmore, Colo, Vesser and Zook.
R108XD863IA	**Till Upland Prairie** Till Upland Prairie. Fine and fine-loamy soils, including Adair, Armstrong, Bucknell, Gara, Lamoni and Shelby.

Similar sites

R108XD862IA	**Sandy Upland Prairie** Sandy Upland Prairie. Sandy and coarse-loamy soils, including Dickinson and Dickman.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Schizachyrium scoparium*

Physiographic features

Loess Upland Prairie is a common site across MLRA 108D. It occurs on ridges, interfluves, and side slopes in uplands within dissected till plain landscapes. Slopes are generally less than 14 percent. The soils range from well drained (on narrow summits and shoulders) to somewhat poorly drained (on broader interfluves with slightly less relief).

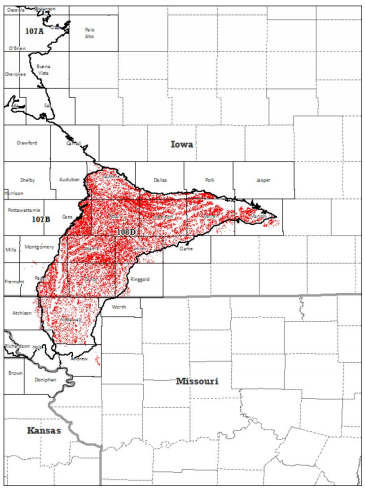


Figure 2. Distribution of Loess Upland Prairie within MLRA 1

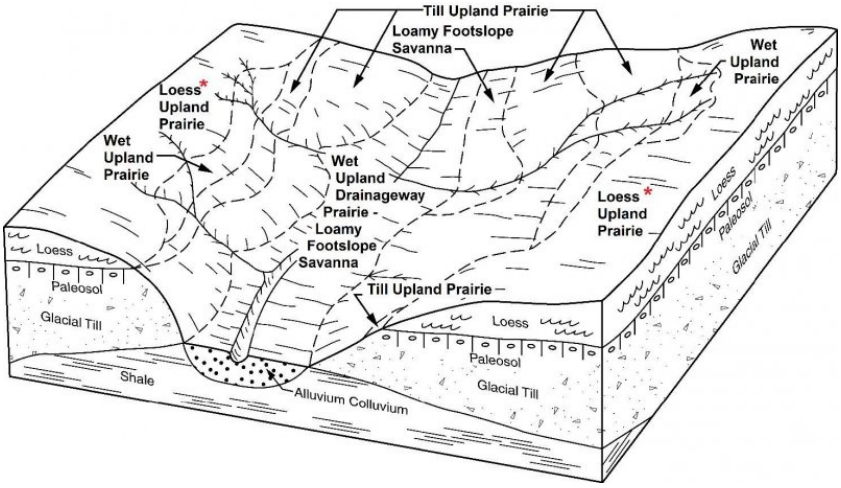


Figure 3.

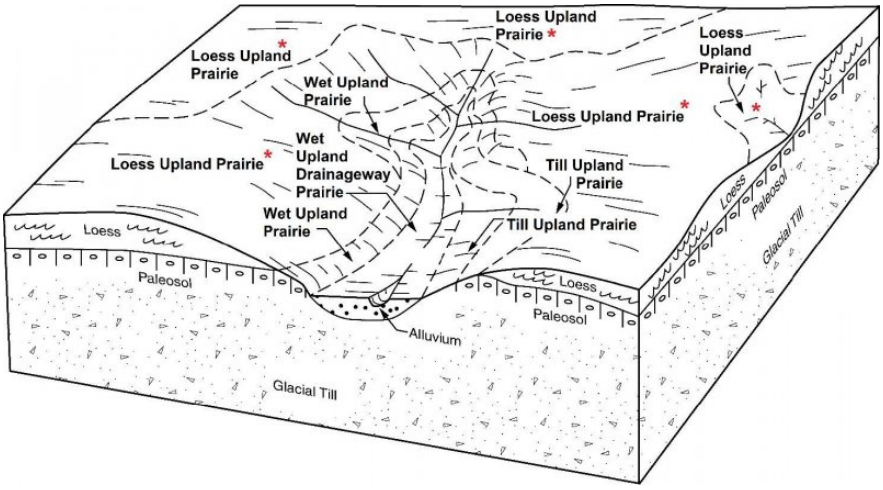


Figure 4. Block diagrams representing typical soil-landform sequences in A) loess ridges and B) loess ridges and glacial till side/footslopes. Red asterisks identify soil components correlated to Loess Upland Prairies.

Table 2. Representative physiographic features

Landforms	(1) Till plain
Runoff class	Negligible to high
Flooding frequency	None
Ponding frequency	None
Elevation	712–1,512 ft
Slope	0–14%

Water table depth	24–80 in
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The soil temperature regime of MLRA 108D is classified as “mesic” where the mean annual soil temperature is between 46 and 59°F (Soil Survey Staff, 2014). The average freeze-free period of this ecological site is about 166 days, while the frost-free period is about 144 days.

Average annual precipitation is 31 inches, which includes rainfall plus the water equivalent from snowfall.. The average annual low and high temperatures are 38 and 60°F, respectively.

Table 3. Representative climatic features

Frost-free period (characteristic range)	136-149 days
Freeze-free period (characteristic range)	158-175 days
Precipitation total (characteristic range)	35-36 in
Frost-free period (actual range)	134-152 days
Freeze-free period (actual range)	157-182 days
Precipitation total (actual range)	35-38 in
Frost-free period (average)	142 days
Freeze-free period (average)	167 days
Precipitation total (average)	36 in

Climate stations used

- (1) CORNING [USC00131833], Corning, IA
- (2) CRESTON 2 SW [USC00131962], Creston, IA
- (3) DES MOINES INTL AP [USW00014933], Des Moines, IA
- (4) INDIANOLA 2W [USC00134063], Indianola, IA
- (5) WINTERSET 1N [USC00139132], Winterset, IA
- (6) CLARINDA [USC00131533], Clarinda, IA
- (7) KNOXVILLE [USC00134502], Knoxville, IA

Influencing water features

This ecological site is not influenced by wetland or riparian water features. Drainage is well to somewhat poor. Permeability is moderate to very slow. The site contains hydrologic groups C, D, and C/D (Hydrologic Soil Group, 2016). Land capability class is 1 for level areas and ranges to 4e for areas on the steepest slopes (Land Capability Classification, 2016). The water source is direct precipitation because there are no upslope contributing sites. Depth of endosaturation ranges from as little as 1 to 4 feet in the spring to greater than 6.5 feet during the rest of the year. Redoximorphic features are present in the soil and can be seen as depletions at depths of as little as 1.5 feet beneath the soil surface. Depletions may exist at shallower depths, but the dark colors of the soil can mask the visibility of these features. It is also important to note that some redoximorphic features which occur above a depth of 40 inches may be related to precipitation events occurring in abnormal years.

Soil features

These soils have no major rooting restriction. The soils formed under prairie vegetation and have dark, organic-rich surface horizons. Parent material is loess. The soils have silt loam and silty clay loam surface horizons (Table 5). Subsoils are silty clay loam to silty clay. Some soils are affected by seasonal wetness in spring months. Soil series associated with this site include Arthur, Givin, Hedrick, Ladoga, Lineville, Macksburg, Nira, Northboro, Pershing and Sharpsburg.

Table 4. Representative soil features

Parent material	(1) Loess
Surface texture	(1) Silt loam (2) Silty clay
Drainage class	Somewhat poorly drained to well drained
Permeability class	Very slow to moderate
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	7.7–8.7 in
Calcium carbonate equivalent (Depth not specified)	0%
Soil reaction (1:1 water) (Depth not specified)	5.6–6.7
Subsurface fragment volume <=3" (Depth not specified)	0–6%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The reference plant community is categorized as an upland prairie and includes grasses, sedges, forbs, and shrubs. Species composition is typically indiangrass (*Sorghastrum nutans*), little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), Canada goldenrod (*Solidago canadensis*), Sporobolus asper, tapered rosette grass (*Dichanthelium acuminatum*), and tall tickseed (*Coreopsis tripteris*).

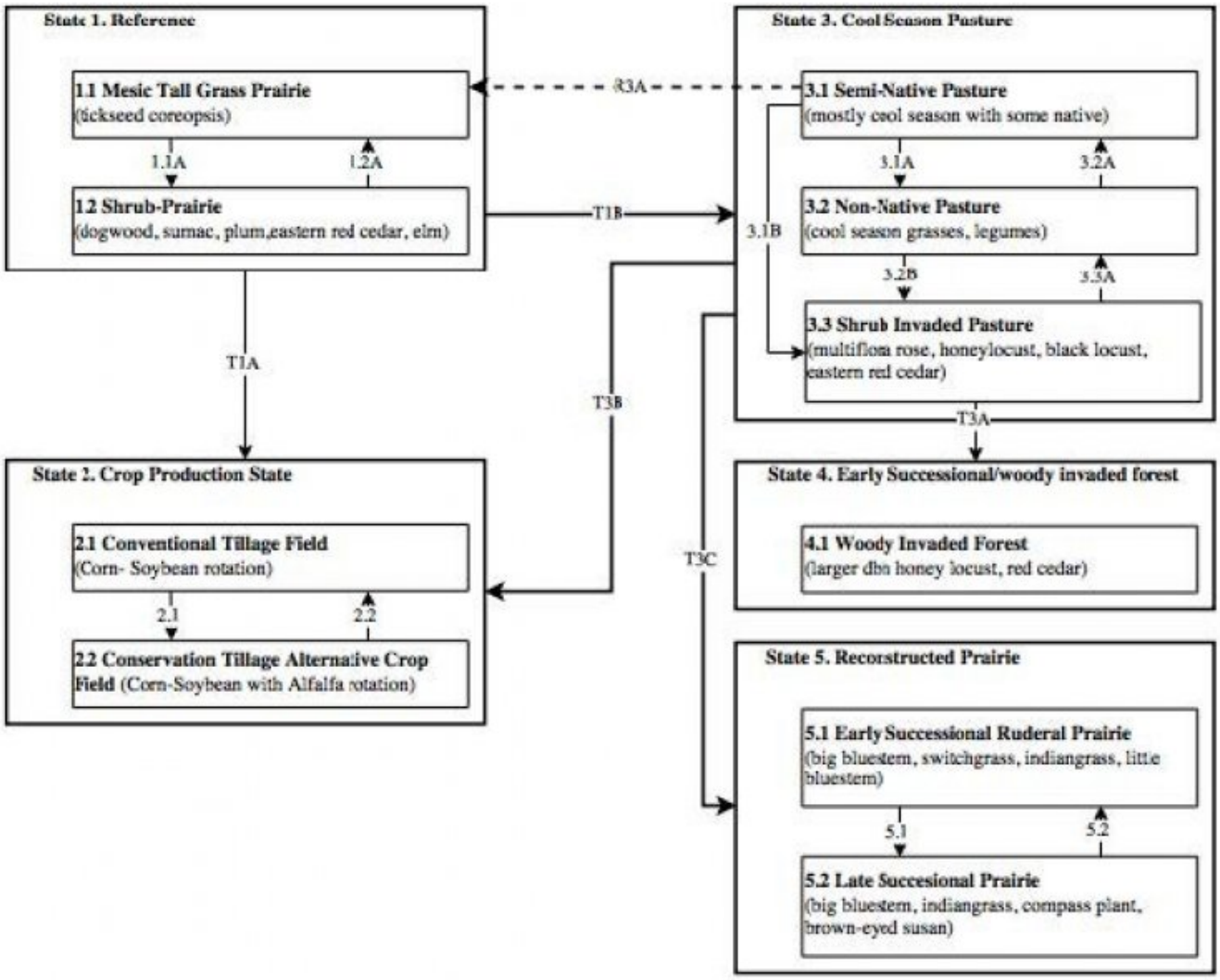
Fire, grazing, and drought are all disturbances influencing the dynamics at this site. These sites likely burned 3 to 5 times every 10 years. Historically, occasional browsing by large ungulates, such as bison (Bison bison), prairie elk (Cervus elaphus), and white-tailed deer (Odocoileus virginianus), might have limited the invasion of woody species into this ecological site (Nelson 2010). Disturbances from these animals removed thatch and litter and reduced the proliferation of small trees and shrubs (Mutel, 2008).

As this region was settled, these prairies were typically altered to better suit agricultural needs. Corn and soybean production is common in these areas today. Very few small remnants of this prairie exist now. While planting prairie species on former prairie sites is beneficial to wildlife, restoration to the reference state from agricultural land is a long-term proposition with uncertain outcomes.

A State and Transition Diagram follows. Descriptions of each state, transition, plant community, and pathway follow. This model is based on available experimental research, field observations, professional consensus, and interpretations. It is likely to change as knowledge increases.

State and transition model

R108DY860IA Loess Upland Prairie



Code	Process
1.1A	Lack of surface fire (8+ yrs), no grazing.
1.2A	Grazing/browsing, frequent orhigher intensity fires (<3yrs).
T1A	Tillage/seeding/herbicide.
2.1	Less Tillage; residue management; crop rotation.
2.2	Intensive Tillage; less residue; monoculture cropping.
3.1A	Herbicide, inter-seeding.
3.2A	Overgrazing, lack ofseeding/herbicide.
3.1B, 3.2B	Abandonment.
3.3A	Brush management/herbicide/seeding.
T3A	Abandonment (20+yrs).
T3B	Sodbuster, tillage, seeding.
R3A	Prescribed fire (spring/earlysummer)/grazing, reduce cool season grasses, selective grass herbicides.
T3C	Site preparation, herbicide, brush management, seeding, tillage.
T1B	Plowing,seeding; overgrazing.
5.1	Natural forb reseeding or by mechanical planting/seeding.
5.2	Forb failure due to drought and/or poor seeding methods.

State 1
Reference State

As a mesic tallgrass prairie, this state has a reference plant community which is categorized as upland prairie and includes grasses, sedges, forbs, and shrubs. Species composition is typically indiangrass (*Sorghastrum nutans*), little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), Canada goldenrod (*Solidago canadensis*), Sporobolus asper, tapered rosette grass (*Dichanthelium acuminatum*), and tall tickseed (*Coreopsis tripteris*). Kentucky bluegrass (*Poa pratensis*) and smooth brome (*Bromus inermis*) are common invasive species. Extended periods with no fire and no grazing can cause this state to shift into a shrub-prairie. Shrubs include multiflora rose (*Rosa multiflora*), smooth sumac (*Rhus glabra*), roughleaf dogwood (*Cornus drummondii*), poison ivy (*Toxicodendron radicans*), *Rubus allegheniensis*, and *Vitis riparia*. Conversely, grazing and browsing accompanied by frequent or high-intensity fires can ultimately shift this phase back towards the reference community (Rosburg,2014).

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- tickseed (*Coreopsis*), other herbaceous

Community 1.1
Mesic Tallgrass Prairie

Tall grassland prairie ecosystem.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- prairie dropseed (*Sporobolus heterolepis*), grass
- tickseed (*Coreopsis*), other herbaceous

Community 1.2
Shrub Prairie

Site invaded by shrub species.

Dominant plant species

- dogwood (*Cornus*), shrub
- sumac (*Rhus*), shrub
- elm (*Ulmus*), shrub
- eastern redcedar (*Juniperus virginiana*), shrub
- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- Indiangrass (*Sorghastrum nutans*), grass

Pathway P1.1A
Community 1.1 to 1.2

Lack of fire 8 plus years, no grazing

Pathway P1.2A
Community 1.2 to 1.1

Grazing/browsing, frequent or higher intensity fires three years interval or less.

State 2
Crop Production State

This state is the most common. Tillage, seeding and herbicide has destroyed all of the original prairie. Corn and soybeans are the principal crops. Variation in management within this state creates a wide range of soil properties and can be detrimental to the environment.

Community 2.1
Conventional tillage field

corn and soybean rotation is most common

Community 2.2
Conservation tillage alternative crop field

corn and soybean rotation with alfalfa rotation

Dominant plant species

- corn (*Zea*), other herbaceous
- soybean (*Glycine*), other herbaceous
- alfalfa (*Medicago*), other herbaceous

Pathway P2.1A
Community 2.1 to 2.2

less tillage; residue management; crop rotation

Pathway P2.2A
Community 2.2 to 2.1

Intensive tillage; less residue; mono-culture cropping.

State 3
Cool Season Pasture State

This state is a native reference state transformed into a cool-season pasture due to a suppression of fire and heavy grazing by livestock. Because there were very little inputs to the original reference state, this state has possibility for restoration to the reference state. This path would need prescribed fire, grazing, and a reduction of cool-season grasses by use of a selective herbicide. With a combination of inputs of non-selective herbicide and inter-seeding, the seminative pasture will transition to a non-native pasture. Continual management is required to prevent invasion of shrubs. Shrubs invade if the site is overgrazed and seeding and herbicide are discontinued.

Community 3.1
Semi Native Pasture

mostly cool season grasses with some natives

Community 3.2
Non Native Pasture

cool season grasses and legumes

Community 3.3
Shrub Invaded Pasture

cool season grasses invaded by multiflora rose, honeylocust, black locust, eastern red cedar.

Pathway P3.1A

Community 3.1 to 3.2

Herbicide, interseeding

Pathway P3.2A
Community 3.2 to 3.1

Overgrazing; lack of seeding/herbicide

Pathway P3.2B
Community 3.2 to 3.3

Abandonment

Pathway P3.3A
Community 3.3 to 3.2

Brush management, herbicide, seeding

State 4
Early Successional Woody Invaded Forest State

Abandonment of the shrub invaded pasture for 20 or more years will result in a woody invaded forest consisting of larger DBH honey locust and red cedar. At this state a significant amount of input and resources would be required to reverse the invaded woody species (Woodland Health, 2004).

Community 4.1
Woody Invaded Forest

larger dbh honey locust and red cedar

Dominant plant species

- honeylocust (*Gleditsia triacanthos*), tree
- eastern redcedar (*Juniperus virginiana*), tree

State 5
Reconstructed Prairie State

Prairie reconstruction is accomplished through site preparation, herbicide, brush management seeding and tillage. Careful management and planting/seeding of forbs or natural propagation will further develop this from an early successional ruderal prairie to a late successional prairie.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- switchgrass (*Panicum virgatum*), grass

Community 5.1
Early Successional Ruderal Prairie

Seeding prairie species in early development

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- switchgrass (*Panicum virgatum*), grass
- Indiangrass (*Sorghastrum nutans*), grass

- little bluestem (*Schizachyrium scoparium*), grass

Community 5.2
Late Successional Prairie

Mix of tallgrass species and native forbs

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- compassplant (*Silphium laciniatum*), other herbaceous
- browneyed Susan (*Rudbeckia triloba*), other herbaceous

Pathway P5.1A
Community 5.1 to 5.2

Natural forb reseeding or by mechanical planting/seeding

Pathway P5.2A
Community 5.2 to 5.1

Forb failure due to drought and or poor seeding methods

Transition T1A
State 1 to 2

Tillage, seeding, herbicide.

Transition T1B
State 1 to 3

Plowing, seeding, grazing

Restoration pathway R3A
State 3 to 1

Prescribed fire/grazing, reduce cool season grasses, selective grass herbicides.

Transition T3B
State 3 to 2

Sodbuster, tillage, seeding

Transition T3A
State 3 to 4

Abandonment 20 years plus

Transition T3C
State 3 to 5

site preparation, herbicide, brush management, seeding, tillage

Additional community tables

Inventory data references

No field plots were available for this site. A review of the scientific literature and professional experience were used to approximate the plant communities for this provisional ecological site. Information for the state-and-transition model was obtained from the same sources. All community phases are considered provisional based on these plots and the sources identified in ecological site description.

Other references

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Contributors

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Approval

Suzanne Mayne-Kinney, 10/17/2024

Acknowledgments

This ESD was originally approved prior to April 2021.

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

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Contact for lead author	
Date	05/12/2025
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

17. **Perennial plant reproductive capability:**